Exercise Solutions for Math 20

Conics (Parabola and Ellipse)

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1.1 Determine the vertex and orientation of the following parabolas.

1.1.a $4y^2 + 4y + x = 2$

$\Rightarrow 4y^2 + 4y = -x + 2$	Isolate y.
$\Rightarrow y^2 + y = -\frac{x}{4} + \frac{2}{4}$	
$\Rightarrow y^2 + y = -\frac{x}{4} + \frac{1}{2}$	
$\Rightarrow y^2 + y + \frac{1}{4} = -\frac{x}{4} + \frac{1}{2} + \frac{1}{4}$	Complete the square.
$\Rightarrow (y + \frac{1}{2})^2 = -\frac{x}{4} + \frac{3}{4}$	
$\Rightarrow (y + \frac{1}{2})^2 = -\frac{1}{4}(x - 3)$	
$\Rightarrow (y + \frac{1}{2})^2 = 4(-\frac{1}{16})(x - 3)$	
$\Rightarrow$ Opening leftwards, $(h, k) = (3, -\frac{1}{2})$	Final answer.
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1.1.b $x^2 - 6x - 2y = 7$

$\Rightarrow x^2 - 6x = 2y + 7$	Isolate x.
$\Rightarrow x^2 - 6x + 9 = 2y + 7 + 9$	Complete the square.
$\Rightarrow (x - 3)^2 = 2y + 16$	
$\Rightarrow (x - 3)^2 = 2(y + 8)$	
$\Rightarrow (x - 3)^2 = 4(\frac{1}{2})(y + 8)$	
$\Rightarrow$ Opening upwards, $(h, k) = (3, -8)$	Final answer.
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